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A pilot study to determine the effects of lean beef consumption on markers of metabolic syndrome

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ABSTRACT

Statement of Objective: To determine the effects of a diet that provides 30% energy from protein with ½ as lean, red meat on risk factors of metabolic syndrome in humans.

Design, Setting, and Participants: A 3-month, randomized, control, intervention trial with 33 participants (Beef-Intervention n=18; DASH-Control n=15) with markers of metabolic syndrome. Registered Dietitians Nutritionists recruited and educated participants on Beef-Intervention Lean Beef Pattern, (30% of energy from protein with ½ as lean red meat, 40% carbohydrate, 30% fat) or DASH-Control dietary pattern, (15% of energy from protein, 55% carbohydrate, and 30 % fat). Of the 33 participants who completed the study; 21 were female and 12 male.

Outcome Measures and Analysis: Bodyweight (BW), fasting serum lipoproteins [total cholesterol (TC), LDL-cholesterol (LDL-C), HDL-cholesterol (HDL-C), and triglycerides (TG)], hemoglobin A1C (HbA1C), dietary satisfaction, and general health status were assessed at baseline and post intervention**.** A three-day diet journal was collected to assess for calorie and macronutrient intake at baseline and post-intervention. Repeated measures analysis was used to determine group differences from baseline to post-intervention and for interactions. Variables were checked for normality, and non-normal variables were transformed prior to analysis. Statistical significance was set at $p \leq 0.05$.

Results: There were no significant changes in total cholesterol, LDL-C, and HDL-C. There was a significant time by group interaction effect for TG (baseline to post; Beef-Intervention 207±87mg/dL to 148±53; DASH-Control, 200±88 to 193±96.) Both groups had decreased BW and HgA1c from baseline to post. Those assigned to Beef-Intervention demonstrated compliance with dietary instructions that included ½ of 30% total calories from protein as lean red meat (baseline to post-intervention; 34.8%±17.7% to 30%±26.8%). Both groups reported a higher level of current dietary satisfaction, a higher level of general health, and walking minutes and total increases in physical activity.

Conclusion and Implications: Lipid parameters, BW, and HbA1C of participants with metabolic syndrome randomized to the Beef-Intervention promoting 30% energy from protein with ½ as lean, red meat had outcomes that were similar or improved to those randomized to DASH-Control diet. The implication is, although larger studies in greater numbers still need to be done, that the inclusion of LRM in calorie-reduced diets may be used short term as an alternative to the DASH diet for those with MetS for weight and TG reduction.

Keywords: Metabolic Syndrome, Beef, Serum Lipid levels

BACKGROUND

Metabolic syndrome (MetS), formerly known as Syndrome X and insulin resistance syndrome, is the name for a collection of risk factors that increase the likelihood for one to develop atherosclerotic heart disease and type 2 diabetes (T2DM). Although there are differing specific definitions of MetS, most researchers agree that the primary symptom is central obesity plus two or more additional risk factors that include: elevated triglyceride levels (≥150mg/dl), low high-density lipoprotein (HDL) cholesterol (<40mg/dl in men, <50mg/dl in women), high blood pressure (systolic blood pressure ≥130mmHg or diastolic blood pressure ≥85mg), and elevated fasting blood glucose (≥100mg/dl) [1-4]. According to the National Health and Nutrition Examination Survey, 2003-06, the number of adults that could be considered as having MetS was about 34.4% of total population. Obese males are 32 times more likely to experience MetS as compared to normal weight males, while obese women are 17 times more likely to be diagnosed with MetS compared to normal weight females [5].

INTRODUCTION

Obesity in the adult population has risen dramatically in the past five years, and the Centers for Disease Control and Prevention estimated that approximately 1/3 of the United States adult population, nearly 72 million adults, are classified as obese, and that number is expected to continue to increase over the next decade or more [2, 5]. These higher rates of obesity have been associated with greater rates of T2DM and cardiovascular disease (CVD), which in turn have led to increased rates of MetS [2, 6]. There are many factors that fall into the metabolic, genetic, and environmental categories that may influence whether one has MetS; however, researchers have identified the two most important factors of influence: obesity and physical inactivity [7, 8]. The excess adipose tissue that occurs around the abdominal area and visceral fat may lead to a chronic, pro-inflammatory state that is synonymous with insulin resistance, which are both considered risk factors for MetS and associated CVD and T2DM [9-14]. MetS is associated with an at least four-fold increased risk of T2DM and a two-times risk of CVD [13]. MetS is now considered a worldwide epidemic as it has inflicted a high socioeconomic cost [14].

There is limited evidence supporting specific dietary treatment for MetS. There is general agreement that weight loss is an effective tool in controlling symptoms of MetS and dietary modification is one of the primary recommendations to achieve weight loss [1, 3]. The dietary intervention listed in the Nutrition Care Manual, the evidence-based manual for therapeutic diets published by the Academy of Nutrition and Dietetics, for MetS is the DASH (Dietary Approaches to Stop Hypertension) regimen. The DASH dietary pattern is composed of fruits, vegetables, low-fat dairy products, decreased consumption of saturated fat, total fat, and cholesterol. This approach also includes increased amounts of whole grains and decreased amounts of refined products, red meat, and sweet items [15-17].

An alternate dietary approach, the Beef in an Optimal Lean Diet (BOLD) [18], embraces similar recommendations for the inclusion of fruits, vegetables, and whole grains as in other diets, but also allows the consumption of lean beef, in addition to other protein choices. For those that are otherwise healthy, the Dietary Guidelines for Americans noted that lean beef could be included in one's diet. Anecdotally, residents of Midwestern states typically consume higher amounts of beef as it is a food that is locally produced and traditionally, highly accepted. Therefore, the BOLD approach with the inclusion of lean red meat may have greater appeal and adherence to dietary adherence than other patterns. The BOLD approach featured a macronutrient breakdown of 54% carbohydrate, 19% protein (with an estimated 4 ounces of lean beef per day), and 28% total fat based on daily caloric needs for the BOLD arm and 45% carbohydrate, 27% protein (with an estimated 5 ounces of lean beef per day), and 28% fat for the BOLD+ arm. Even though, the BOLD approach is one of the few studies to evaluate effects of beef on serum lipid levels, those with MetS were excluded. Therefore, there is still a question about the inclusion of lean beef for those with MetS.

The purpose of this pilot study was to determine the effects of a dietary education intervention providing 30% energy from protein with ½ as lean, red meat on risk factors of MetS in humans. We hypothesize that those randomized to the Beef diet will show similar outcomes on serum lipid levels as those following the DASH diet.

METHODS AND SUBJECTS

Study Design

This was a 12-week, randomized, control, dietary education intervention with rolling enrollment. A total of 39 participants displaying markers of MetS were recruited for participation. Participants aged 18-65 years and in a rural state were recruited by Registered Dietitian Nutritionists (RDNs) to participate through an area healthcare facility and specialty clinic. Once qualification for the study was determined, assessments were conducted at baseline and post-intervention (approximately 12 weeks from baseline).

Subjects

Participants were recruited by RDNs through referral from health care personnel or self-referral via informational study fliers posted in each location. Qualifications for participation in the study included central obesity (waist circumference > 35 inches in women, >40 inches in men) plus two or more additional risk factors including elevated triglyceride levels (≥150mg/dl), low high-density lipoprotein (HDL) cholesterol (<40mg/dl in men, <50mg/dl in women), high blood pressure (systolic blood pressure ≥130mmHg or diastolic blood pressure ≥85mg), or elevated fasting blood glucose (≥100mg/dl). Participants were randomly assigned to a group (Beef-Intervention or DASH-Control), stratified by location, by random number generator.

The costs of baseline and post-intervention study serum lipid measurements along with education meetings by the RDN were reimbursed by the study. Participants were also offered up to $100 ($25 for baseline labs, $25 upon completion of baseline dietary education, and $50 post dietary education) as gift cards from the local grocery store. Participant consent was obtained in accordance with the policy statements of Human Subjects Committee at South Dakota State University prior to enrollment.

Participants received three face-to-face education visits with the study-trained RDN. During their first face-to-face meeting, participants received education and instruction about their specific daily calorie target, as well as appropriate serving sizes for foods in the carbohydrate, protein, and fat groups. Participants also received educational materials showing which cuts of beef were considered lean versus those that contain higher amounts of fat and were instructed by the RDNs to choose a leaner beef product over the fattier beef product. Those that were assigned to the Beef-Intervention group were instructed to follow a high-quality protein, moderate carbohydrate diet that provided 30% of energy from protein with ½ as lean, red meat, 40% carbohydrate and 30% fat. Those following the DASH-Control diet were instructed to follow a diet that provided 15% of energy from protein, 55% carbohydrate, and 30% fat. Participants received a second visit with the RDN at about week 7 of their participation period (about the halfway point) to reinforce dietary pattern education. During their final visit, participants reviewed their final serum lipid values with the RDN. All participants were encouraged to include the minimum amount of 150 minutes/week of moderate activity. All education sessions included tenets of health coaching by RDN for dietary adherence. Participants were requested to set weekly goals and maintain dietary and physical activity logs to increase adherence to the prescribed interventions.

Assessments

The following measures were collected at baseline and post-intervention (12 weeks): height, weight, fasting serum lipoproteins (total cholesterol, LDL-cholesterol, HDL-cholesterol, and triglycerides), hemoglobin A1C (HbA1C), 3-day diet records, physical activity questionnaire, dietary satisfaction survey, current medications, and brief patient-reported medical history.

Anthropometric measures: Height was measured without shoes. Weight was recorded in light-weight clothing on clinical scales.

Serum lipoproteins and HgA1C: Total cholesterol, LDL-cholesterol, HDL-cholesterol, triglycerides, and HbA1C were collected via venous puncture and measurements analyzed by a CLIA-approved laboratory.

Dietary intake and adherence: All participants were instructed to record amount and type of food for 3 days at baseline and post-intervention. Diet records were analyzed for nutrient content using ESHA Food Processor SQL, (version 10.8.0, 2011, Salem, OR 97306). Dietary adherence as determined by comparing diet records with prescribed diet.

Dietary satisfaction: Dietary satisfaction was measured at baseline and post-intervention with one question "How would you describe your current satisfaction level with diet?" with a seven-point Likert scale responses that ranged from "terrible" to "delighted". A higher score indicated greater satisfaction.

Medications and general health: Medication use was measured by the number of self-reported medications. Participants were queried about their general health with one question, "Would you say that in general, your health is:" with six-point Likert scale responses that ranged from "excellent" to "not sure." A lower score indicated better-perceived general health of the participant.

Physical activity: The International Physical Activity Questionnaire (IPAQ) was used to assess amounts of physical activity (PA) at three intensity levels (vigorous PA, moderate PA, and walking). Physical activity minutes were converted to Metabolic Equivalents (METs or MET-minutes) per week to generate total walking, moderate activity, and vigorous activity scores [19].

Analysis of Data

Power calculations [20] were completed using G*Power 3 with the following assumptions: power was set at 0.95, α was set at 0.05, 2-tailed tests, and effect size of 0.25. It was estimated that a sample size of 36 was sufficient to determine significant differences in LDL concentrations. Significance was determined in all variables using Repeated Measures and Mixed Model Procedure (PROC MIXED) analyses, (SAS 2002-2010, version 9.3, Cary, NC, USA). Normality tests were run on all variables and those that significantly deviated from normal (General Health, Walking Minutes, MPA, VPA, Sitting Hours, TPA) were analyzed with Univariate nonparametric analyses. Statistical significance was set at $p \leq 0.05$. Data are presented as mean ± standard deviation (SD).

RESULTS

Subjects and Anthropometrics

Of the 39 recruited, [Beef =18, 10 females; DASH=15, 11 females] thirty-three participants completed the 12-week study period. Six (5 Beef-Intervention, 1 DASH-Control) chose not to continue after consenting and randomization, and their data were not included in analysis. At baseline, the sample was 63% female, 27% high school diploma, 73% with associate's degree or higher, and 100% Caucasian (Table 1). Both groups demonstrated significant decreases in body weight and BMI over time (Table 1).

Serum Lipoproteins and HgA1C

There were no significant changes in total cholesterol, LDL-C, and HDL-C between groups due to the intervention. There was a significant time x group effect for TG from baseline to post-intervention (Table 2).

Table 1. Comparison of Age and Anthropometric Measurements at Baseline and Post-Intervention

				Significance[1]		
Characteristic		**Baseline**	**Post Intervention**	**Group x time**	**Group**	**Time**
Age, Years (mean±SD)	Beef	56.2±11.6	57.6±11.5	--	NS[2]	--
	Dash	49.4±12	50.7±15			
Weight, kg (mean±SD)	Beef	97.6±19.6	92.6±19.4	0.41	0.17	<0.0001
	Dash	107.2±23.0	103.4±21.6			
BMI, kg/m (mean±SD)	Beef	34.5±6.5	32.7±6.5	0.31	0.28	<0.0001
	Dash	36.7±6.3	35.5±6.1			
Body Mass Index Category						
Overweight/Obese, %	Beef	100%	94%			
	Dash	93%	93%			

[1]Repeated measures analysis was used to determine group differences from baseline to post-intervention. Statistical significance was set at $p \leq 0.05$.
[2] No significant differences between groups.

Table 2. Serum Lipid Concentrations from Baseline and Post-Intervention

				Significance[1]		
Characteristic		**Baseline mean±SD**	**Post Intervention mean±SD**	**Group x time**	**Group**	**Time**
Serum Lipid Values						
Total Cholesterol (mg/dL)	Beef	195.2±36.2	190.4±41.1	0.86	0.92	0.31
	Dash	196.3±33.9	190.0±46.5			
LDL (mg/dL)	Beef	117.8±30.1	117.8±30.1	0.87	0.69	0.79
	Dash	122.5±25.9	120.6±37.2			
HDL (mg/dL)	Beef	43.5±12.6	45.5±10.9	0.20	0.25	0.25
	Dash	33.6±9.7	39.5±11.0			
Triglycerides (mg/dL)	Beef	207.2±87.5	148.4±53.1	0.05	0.40	0.01
	Dash	199.8±88.1	193.4±95.9			
HbA1C (%)	Beef	6.1±0.93	5.8±0.89	0.26	0.42	0.02
	Dash	6.2±0.88	6.1±0.74			

[1]Repeated measures analysis was used to determine group differences from baseline to post-intervention. Statistical significance was set at $p \leq 0.05$.

Dietary Intake and Satisfaction

Both groups reported a higher level of current dietary satisfaction (Table 3). There were no significant differences in reported dietary intake between groups (Table 3). Mean intakes were within prescribed ranges. Participants randomized to Beef-Intervention dietary pattern displayed adherence (by analysis of dietary journals) to the inclusion of 30% protein with one-half as lean, red meat (not reported in tables).

Table 3: Comparison of Dietary Satisfaction and Intake

Characteristic		Baseline[2]	Post Intervention[2]	Significance[1] Group x time	Group	Time
Current Diet Satisfaction[3]	Beef	4.1±1.2	5.1±1.4	0.69	0.40	0.0004
	Dash	4.2±1.2	5.5±0.8			
Dietary Intake						
Total Calories (kcal/day)	Beef	1667±310	1629±352	0.48	0.21	0.81
	Dash	1452±448	1554±275			
Protein (g/day)	Beef	93±29	103±32	0.22	0.03	0.83
	Dash	81±32	74±21			
Protein from Beef (g/day)[2]	Beef	33±27	37 ±40	0.53	0.18	0.97
	Dash	23±33	19 ±18			
Carbohydrates (g/day)	Beef	165±56	162±36	0.41	0.54	0.60
	Dash	164±54	183±42			
Fat (g/day)	Beef	72±21	65±21	0.28	0.07	0.95
	Dash	53±21	59±15			

[1]Repeated measures analysis was used to determine group differences from baseline to post-intervention. Statistical significance was set at $p \leq 0.05$.
[2]Mean±SD
[3]Measured with one question "How would you describe your current satisfaction level with diet?" with 7 scale response that ranged from "terrible" to "delighted", higher score indicates greater satisfaction.

Table 4. Physical Activity and Health and Daily Activities of Participants at Baseline and Post-Intervention

Characteristic		Baseline mean±SD	Post Intervention mean±SD	Significance[1] Group x time	Group	Time
Medications and General Health						
Number of Medications[1]	Beef	3.7±1.6	3.7±1.3	0.35	0.86	0.35
	Dash	3.8±2.7	3.8±2.7			
Current General Health[2,3]	Beef	3.1±0.7	2.6±0.7	--	0.03	--
	Dash	3.1±1.3	2.8±0.4			
IPAQ[4]						
Walking MET-min per week[4,5]	Beef	545±639	848±1270	0.61	0.17	0.10
	Dash	832±916	1367±952			
Moderate PA MET-min per week[4,5]	Beef	1475±3356	1165±2971	0.68	0.85	0.85
	Dash	1077±2238	1227±1562			
Vigorous PA MET-min per week[4,5]	Beef	462±638	780±1014	0.32	0.57	0.06
	Dash	308±485	1567±2851			
Total PA MET- min per week[3,5]	Beef	1612±1608	3113±4459	0.95	0.63	0.004
	Dash	2216±2811	4161±4552			
Sitting Minutes per day[4,5]	Beef	307±174	320±190	0.08	0.50	0.20
	Dash	363±110	318±131			

[1]Repeated measures analysis was used to determine group differences from baseline to post-intervention. Statistical significance was set at $p \leq 0.05$.
[2]Participants queried about general health, "Would you say that in general, your health is:" with six-point Likert scale responses that ranged from "excellent" to "not sure," lower score indicates better general health.
[3]Univariate procedure SAS version 9.3 was used to determine between group differences in change from baseline to post-intervention.
[4]International Physical Activity Questionnaire (IPAQ) was used to assess amounts of physical activity (PA) at three intensity levels (vigorous PA, moderate PA and walking). Physical activity minutes were converted to Metabolic Equivalents (METs or MET-minutes) per week to generate total walking, moderate activity, and vigorous activity scores.
[5]Variables were assessed for normality and analyzed using non-parametric test for interaction.

General Health and Physical Activity

Both groups reported a higher level of general health. There were no between group differences in PA in any category from baseline to post-intervention. (Table 4).

DISCUSSION

Numerous studies have been conducted that measure the effects of inclusion of lean red meat (LRM), lean white meat (LWM), and fish or poultry in the diet on total cholesterol levels and occurrence of hypertension. However, there are few studies that have looked exclusively at the inclusion of lean red meat on symptoms of MetS as reported in this paper. Davidson and colleagues [21] conducted an education intervention study that compared the effects of LRM versus LWM in diets containing 15% of calories as protein on serum lipid levels of participants with hypercholesterolemia. Participants were randomized to a diet with 170g lean meat/day of either LRM or LWM, over 5-7 days/week. This amount of protein accounted for 80% of daily protein recommendations. Both groups had similar reductions in TC, LDL-C, HDL-C, and TG concentrations. Similarly, in the study reported in this paper, greater reductions in TG concentrations were observed in participants who were randomized to the Beef-Intervention pattern (30% of calories from protein with one-half from lean red meat) versus those randomized to the DASH-Control dietary pattern (15% of calories from lean meat).

The dietary patterns for the Beef study described in this paper were chosen to determine if consuming higher amounts of lean red meat affects serum lipids and body weight differently than a DASH dietary pattern. The results from the Beef study are similar to those reported by Roussell and colleagues in their BOLD study [18] in that diets with lean red meat have similar outcomes to those of DASH Dietary pattern. The difference between the BOLD study and the Beef study reported in this paper is that the BOLD study recruited participants who were otherwise healthy, but displayed elevated LDL-C concentrations. Exclusionary criteria included type 2 diabetes, stroke, liver, kidney or autoimmune disease, as well as those that were currently prescribed cholesterol and lipid-lowering medications. While in the Beef study, participants displaying symptoms of MetS were recruited and allowed to continue with prescribed medications. The BOLD Study participants on the experimental diets of BOLD, BOLD+, or DASH dietary patterns displayed a reduction in TC and LDL-C with no differences between the groups. Comparatively, in the Beef study there were significant decreases in TG concentrations for those in the Beef-intervention group versus those in the DASH-control group, but no changes or differences between groups in TC and LDL-C. The differences in outcomes between the Roussell's BOLD study and the Beef study may be that those in our Beef study had markers of MetS, such as high TG concentrations.

Another positive outcome from this study was that both the Beef-Intervention and the DASH-Control participants lost weight and decreased BMI as expected based on the dietary prescriptions. All participants were provided dietary prescriptions within the respective macronutrient components with calorie restrictions approximately 500 kcal less than calculated requirements. The significant weight loss from baseline to post-intervention was an indication of dietary adherence. Participant adherence to dietary instruction is essential to the success of a dietary intervention, and this is often accomplished through the use of educational sessions to teach participants fundamentals such as serving size, meal composition, menu planning, and cooking skills. The Beef study utilized trained RDNs to provide dietary education to participants. This component may have supported a higher level of dietary adherence for both groups. Both groups received face-to-face dietary education from the RDN as well as written meal component instructions, along with a list of food item examples to refer to during the 12-week period. Those randomized to the Beef-Intervention also received a fact sheet identifying lean cuts of beef. Numerous studies have been conducted that allude to the effectiveness of participant dietary pattern adherence when RDNs are involved with the study. Zazpe and colleagues [22] focused on dietary adherence in their study that utilized Mediterranean-type diets in conjunction with the Prevención con Dieta Mediterránea (PREDIMED) that was conducted in Spain. The study was a 12-month behavioral intervention that included approximately 1,500 participants who were randomized to one of three dietary patterns, which included: a control diet that was based on the National Cholesterol Education Program (NCEP) Adult Treatment Panel (ATP) III Step I diet, a Mediterranean (Med) diet plus virgin olive oil, and a Mediterranean diet plus mixed nuts. Those randomized to both Mediterranean diets received motivational interviews from trained RDNs and participated in group educational classes every three months. Those randomized to the Control group were given verbal instructions and a pamphlet with recommendations for their dietary guidelines, but no motivational interviews by RDN. Compliance was measured by biomarkers for specific foods. Those participants who received education intervention by trained RDNs had greater compliance.

In another study that utilized RDNs to educate participants, Parker and colleagues [23] reported that patients diagnosed with pre-diabetes displayed better clinical outcomes, specifically HbA1c and Diabetes Risk Score (DRS) than those that received Usual Care (UC) treatment which did not include education by the RDNs. Participants randomized to Medical Nutrition Therapy (MNT) treatment received 60 minutes of individualized education, a 24-hour diet recall, a pedometer, and a diary to record their daily steps and minutes of PA, while those randomized to UC were instructed to return after the 12-week period. The MNT group displayed a significant difference between groups at 12-weeks for DRS, in addition, to 95% of participants reporting at least 30 minutes of PA compared to the UC group. Both groups displayed significant decreases in TC and LDL-C. The resulting higher level of dietary adherence as seen in the Mediterranean diet and MNT studies due to the involvement of RDNs is similar to that of the Beef study which resulted in a high level of adherence in both groups, as evidenced by the significant decreases in BW and TG. In addition, participants in the Beef study reported a higher level of diet satisfaction as well as general health at the end of the study period, when compared to baseline responses.

There are limitations to the generalization of the results from the Beef study. This was a 12-week intervention period, which allowed changes in serum lipids and weight loss; however, longer trials are necessary to determine long-term adherence and outcomes. Even though the trial was conducted with the use of trained registered dietitians to deliver the education, this trial was conducted with free-living participants and dietary data was collected through self-report versus housing in a metabolic ward and/or providing the meals in a clinical institution. Although the participants were randomized to intervention or control, the recruitment occurred through convenience sampling. The participants recruited may have been more interested in changing dietary behavior as they were recruited through health care providers and posters in respective clinics.

CONCLUSION

Based on the results of this pilot study, it appears that calorie reduction diets that include 30% protein with one-half as LRM have outcomes similar to the DASH dietary pattern in those with MetS. The implication is, although larger studies in greater numbers still need to be done, that the inclusion of LRM in calorie-reduced diets may be used short term as an alternative to the DASH diet for those with MetS for weight and TG reduction.

Competing Interests

The authors have no financial interests or conflicts of interest.

Authors' Contributions:

All authors contributed to this study.

Abbreviations:

MetS, Metabolic Syndrome; T2DM, Type 2 Diabetes Mellitus; CVD, Cardiovascular Disease; HDL-C, High Density Lipoprotein Cholesterol; LDL-C, Low Density Lipoprotein Cholesterol; TC, Total Cholesterol; BW, Body Weight; CRP, C-Reactive Protein; DASH, Dietary Approach to Stop Hypertension: BOLD, Beef in Optimal Lean Diet; RDN, Registered Dietitian Nutritionist; TG, Triglycerides; ANOVA, Analysis of Variance; LRM, Lean Red Meat; LWM, Lean White Meat; PREDIMED, Prevención con Dieta Mediterránea; MNT, Medical Nutrition Therapy; UC, Usual Care; DRS, Diabetes Risk Score.

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